

ATTACHMENT 8

THE DOWNSTREAM DILUTION OF STREAM SEDIMENT ANOMALIES

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ABSTRACT

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The following idealized formula relates the metal content of an anomalous stream sediment sample (Me_a) and the upstream drainage area (A_a) with the grade (Me_m) and the surface area (A_m) of the mineralized area, provided the background (Me_b) is known and constant:

$$Me_m A_m = A_a (Me_a - Me_b) + A_m Me_b$$

In deriving the formula, the assumptions are made that within the area represented by the anomalous sample, erosion is uniform and there is no more than one anomalous source, no sampling error, no contamination, and no feedback of metal between sediment and water. The degree to which the ideal formula is approached in actual practice has been checked by field observations at four recently discovered porphyry copper deposits — Cerro Colorado, Casino, Chaucha and Rosemont. It is concluded that within reasonable limits, the assumptions are valid and that the formula has potential applications in the planning of sediment sample layouts, and in the interpretation of sediment sample data.

INTRODUCTION

Reconnaissance mineral exploration based on the distribution of ore metals in stream sediments has become a generally accepted method of mineral reconnaissance. This approach seems to work almost equally well in all climates and all kinds of terrain, provided of course that the ore deposits being sought are exposed at or near the surface and are actively undergoing erosion. Nobody with any experience in the field would question the validity of the concept on which stream sediment reconnaissance is based.

Considerable dispute does arise, however, over the detailed logistics of planning a sediment sampling program and the interpretations of the resulting data. How big a stream can be safely sampled without danger of losing the anomaly by dilution from background tributaries? Does a large number of samples per unit area collected at random sites give better coverage than a few samples from carefully selected sample sites? How can strong anomalies in small streams be compared with weak anomalies in large streams or big rivers? These and many other questions plague the exploration geochemist engaged

in a program of mineral reconnaissance.

All of these questions hinge on the rate at which anomalous sediment derived from a mineralized source is diluted by sediment of background composition from unmineralized terrain. Because of the considerable number of ambiguities and uncertainties involved in this problem of dilution rate, the exploration geochemist has been forced to develop a kind of intuitive judgment in answering these questions, a judgment that usually leads to valid conclusions but that may leave him wishing that he had a more quantitative way of approaching the problem.

The purpose of this paper is to bring these problems into better focus by presenting a formula that may help the field man in visualizing the effect of anomaly dilution.

FORMULA FOR DILUTION OF SEDIMENT ANOMALIES

Translated into terms that are relevant in a stream sediment reconnaissance, grade and tonnage can be expressed as the product of the metal content (Me_m) of the source material (residual soil, leached capping or primary ore exposed at the surface and undergoing active erosion) times the dimensions of the mineralized area (A_m) in square miles or square kilometers. If we are now ready to accept certain simplifying assumptions (uniform rate of erosion, uniform background, no feedback between water and sediment, no sampling error, a single anomalous source, and no contamination), then we may consider the following formula relating the composition of sediment samples and drainage areas to the character of the mineralized source, and hence the size and grade of the deposit causing the anomaly:

$$Me_m A_m = A_a (Me_a - Me_b) + A_m Me_b$$

where Me_m = metal content of material undergoing active erosion within the mineralized area, Me_a = metal content of anomalous stream sediment collected in drainage downstream from the mineralized area, Me_b = metal content of background sediment samples, A_m = surface dimensions of mineralized area, and A_a = dimensions of drainage area above anomalous sediment sample.

The parameters used in the formula are illustrated graphically in Fig. 1. As used here, "metal content" refers to the total content of metal in the sample, and not to any selectively extractable fraction of the metal.

What this formula says is that the grade-tonnage factor ($Me_m A_m$) is equal to the product of the drainage area above the sample site times the excess of the anomalous value over background, plus a small correction factor that is of negligible consequence where the drainage area is large compared with the area of the source.

This formula is a variation of that presented by Rose et al. (1970) who were concerned mainly with estimating the effects of a mixture of different rock types on the composition of stream sediments. Polikarpochkin (1971) has presented a somewhat similar formula where he speaks of a "productivity

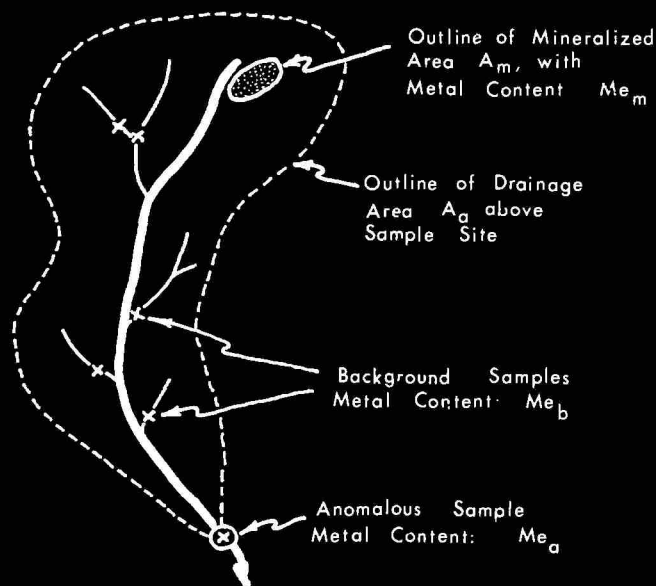


Fig.1. Definition of parameters.

factor" without equating it to the product of grade and area of source. His productivity factor is computed simply as $A_a(Me_a - Me_b)$ without the second term $A_m Me_b$.

ASSUMPTIONS IN DILUTION FORMULA

A natural drainage basin within which a metal-rich deposit is undergoing erosion lacks the quantitative elegance of a laboratory experiment where all the irrelevant and unwanted variables are closely controlled. It is easy to think of at least ten factors that could influence the reported metal content of an anomalous sediment sample. However, if we are to have a formula for dilution containing a manageable number of variables, it is absolutely necessary to make some simplifying assumptions about some of the factors that we hope are not of major importance. Following are the principal assumptions that must be made if we are to keep the parameters of our formula down to five:

- (1) the erosion rate is constant throughout the drainage area. This premise begins to break down where part of the area is mountainous and undergoing rapid erosion while another is low-lying and eroding slowly, while still another may be covered up by later sediments and not exposed at all.
- (2) Background is constant throughout the area. This assumption may be very weak where the area is underlain, for example, by mixed silicic rocks of low metal content and basic volcanics which are relatively rich in the ore metals.

(3) There is no hydromorphic feedback between metal dissolved in the stream water and the metal carried in particulate form in the stream sediments. This assumption is the most nearly valid for extremely immobile and insoluble metals like lead. Substantial amounts of some metals such as copper may enter a drainage system in solution in the acid waters derived from an oxidizing sulfide deposit; these metals may then be precipitated and become part of the sediment fraction as the acidity is progressively neutralized downstream. This phenomenon might be expected to cause at least a partial breakdown of the formula in the section of the stream where this type of feedback between water and sediment is taking place.

(4) No sampling or analytical errors are involved. This means standardizing as far as feasible the type of sample collected at each site. Sample variability is likely to be much more marked for samples collected very close to the anomalous source, where mixing has not gone to completion.

(5) The area contains only one source of anomalous metal. If desired the formula can be modified to cover multiple sources (A_{m1} , A_{m2} , etc.) by simply substituting $\sum_{k=1}^n Me_{mk}$ for $Me_m A_m$ and $\sum_{k=1}^n A_{mk}$ for A_m .

(6) The drainage system is not contaminated by the addition of metals from mine waters, dumps, tailings, or industrial waste.

DERIVATION OF DILUTION FORMULA

With the above assumptions, let Se_p = mass (grams) of sediment passing any point P in any given unit of time (say one year); K = erosion rate in mass (grams) per unit area (km^2) per unit of time (year) = constant according to assumption 1; and A_p = area (km^2) above point P. Then:

$$Se_p = KA_p$$

Now let G_p = mass (grams) of metal (say copper) passing point P each unit of time (year), and Me_p = content (ppm) of metal (copper) in sediment passing point P. Then:

$$G_p = Me_p Se_p = KMe_p A_p$$

Now consider a mineralized area A_m in which the metal content of the surficial material is Me_m . Then the mass of metal per unit time undergoing erosion from the mineralized area and entering the drainage system, before it is diluted by any background streams, is:

$$G_m = KMe_m A_m$$

Similarly streams from background areas carry a mass of metal per unit time that is proportional to the product of the dimensions of the unmineralized area and the metal background:

$$G_b = KMe_b A_b$$

At any anomalous site downstream from the mineralized area, the flow of metal G_a is proportional to the product of the upstream drainage area (A_a) and the metal content of the sediment at that point (Me_a). It is also equal to the sum of contributions from both the mineralized area and background areas:

$$G_a = KMe_a A_a = G_m + G_b = KMe_m A_m + KMe_b A_b$$

Clearing the constant K ,

$$Me_a A_a = Me_m A_m + Me_b A_b$$

Now:

$$A_a = A_m + A_b \quad \text{or} \quad A_b = A_a - A_m$$

Therefore:

$$Me_a A_a = Me_m A_m + Me_b (A_a - A_m)$$

or:

$$Me_m A_m = A_a (Me_a - Me_b) + Me_b A_m$$

FIELD CHECKING OF DILUTION FORMULA

Our formula may fit the ideal situation, but how does it work in actual practice? In other words, how good are the assumptions we have made in an effort to reduce the number of variables? The only really convincing way of checking the formula and the assumptions is to find field examples of large mineral deposits where all five of the parameters in the formula can be measured and also where the drainage has not been contaminated by mining activity. Porphyry copper deposits, with their large areas of exposure, make the best examples. Such field examples are not easy to find, as it is customary to put any large and attractive deposit into production just as soon as possible after discovery.

Four examples of porphyry copper deposits where the downstream drainage was sampled very soon after discovery are described below. With each of these, measured values of the parameters A_a , Me_a , A_m , and Me_m are substituted in the rearranged formula below:

$$Me_m = \frac{A_a}{A_m} (Me_a - Me_b) + Me_b$$

and a value for Me_m , the tenor of the source, was computed. Results are shown in Table I. In this tabulation, the consistency of replicate values for Me_m computed from data collected at different distances below the source, and the correspondence of these computed values with the actual metal content of soil or ore in the source area may be taken as a measure of the validity

TABLE I

Tenor of source material computed from stream sediment data by formula $Me_m = (A_a/A_m)(Me_a - Me_b) + Me_b$

	Sample metal number		Distance below deposit (km)	Drainage area, A_a (km ²)	Area of source, A_m (km ²)	Ano-malous value, Me_a (ppm)	Back-ground, Me_b (ppm)	Tenor of source, Me_m (ppm)	
								computed	actual
Cerro Colorado, Panamá	1	Cu	47	300	1.5	160	115	9115	7500
	2		6	48		195		2675	(ore)
	3		4	45		350		7165	
	4		2.5	16.5		650		6000	
	5		1	10.6		1308		8546	
Casino, Yukon	1	Cu	13	80.5	0.35	122	54	15,694	2000+
	2		10	39.4		306		28,422	(rock)
	3		5	20.2		780		41,955	
	4		1.6	2.34		1000		6379	
	1	Mo	13	80.5	0.35	2	1	231	100+ (MoS ₂
	2		10	39.4		6		564	in rock)
	3		5	20.2		6		289	
	4		1.6	2.34		150		997	
Chaucha, Ecuador	1	Cu	45	900	4.0	69	40	6565	1000+
	2		4.5	356		300		23,180	(soil)
Rosemont, Arizona	1	Cu	26	140	1.0	35	17	2537	not known
	2		23	136		30		1785	
	3		22	124		30		1629	
	4		16	109		35		1979	
	5		15	105		40		2432	
	6		12	83		45		2341	
	7		10	63		55		2411	
	8		7	36		100		3005	
	9		6	28		100		2341	
	10	a	3.5	15		95		1187	
	11	a	1.5	5.3		450		2312	
	12	b	4.0	5.8		140		730	
	13	b	2.0	2.6		520		1325	

(a) South branch (Barrel Canyon) leading to Rosemont deposit.

(b) North branch (McClary Canyon) leading to area of old copper prospects.

of the formula. Failure of these computed values to correspond with expectations would presumably be a measure of the breakdown of the simplifying assumptions that went into the derivation of the formula.

Cerro Colorado deposit, Panamá

The Cerro Colorado porphyry copper deposit in Panamá, (Kents, 1975) is

located about 300 km west of Panamá City. Sample 1 (Table I and Fig.2) was collected by the writer at the Interamerican Highway bridge over the Río San Félix, and analyzed by W.K.L. Thomas of the United Nations Mineral Project in Bogotá as part of the Project's orientation program on porphyry copper

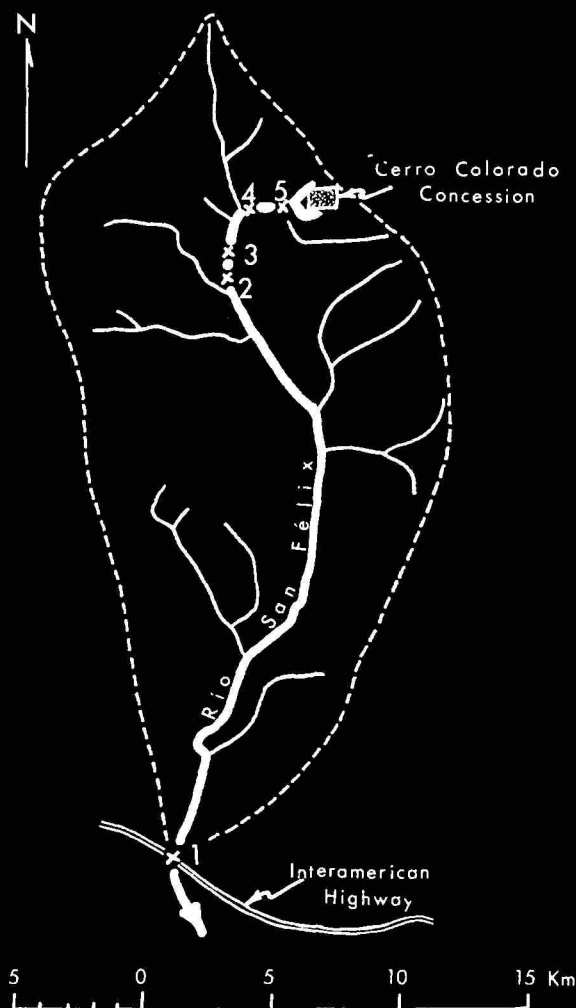


Fig.2. Sediment samples below Cerro Colorado deposit, Panamá.

exploration. Samples 2–5 and the samples used in computing background were collected and analyzed by the staff of Pavonia-Canadian Javelin Ltd., who kindly released the data for use in this paper. Values for A_a , the drainage areas above anomalous samples, were scaled from the sample location map provided by the mining company. A_m , the area of mineralization, was taken as 1.5 km^2 , the area of the original Pavonia concession. Me_b , background, was taken as the median Cu content of 104 sediment samples collected at dis-

tances of more than 3 km and less than 15 km from the edge of the concession area. Me_m , the grade of ore (7500 ppm), is quoted from World Mining (1974). All samples show a computed value for Me_m in an economically interesting range, and four out of five are within $\pm 50\%$ of the "measured" value.

Casino deposit, Yukon Territory

The Casino porphyry copper deposit is located 300 km northeast of Whitehorse in the Yukon Territory, Canada, in an unglaciated permafrost terrain. The location of the samples shown in Fig.3 and their Cu content as

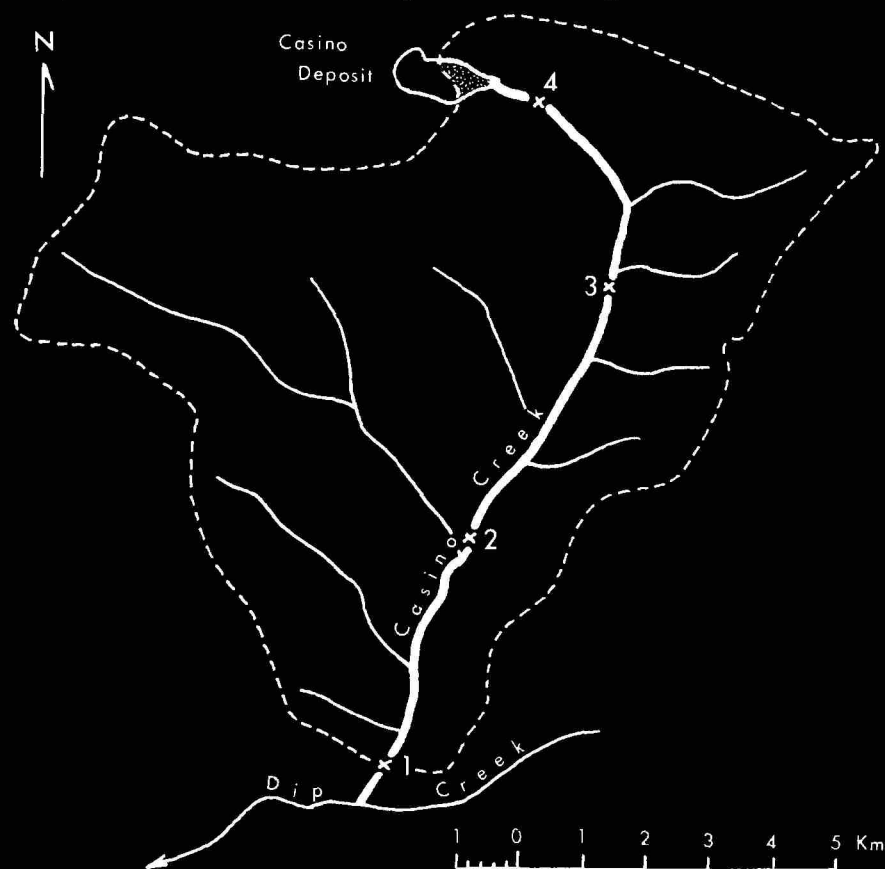


Fig.3. Sediment samples below Casino deposit, Yukon Territory.

given in Table I were taken from Horsnail and Fox (1974). Figures for A_a , the drainage areas above anomalous samples, were scaled from the 1:50,000 Provisional Map 115 J/10 of the Canadian Department of Energy, Mines and Resources. The area of the mineralized source, A_m , for both Cu and Mo was

scaled from the area bounded by the divide and the 2000-ppm Cu (bedrock) contour in fig.1 of Archer and Main (1971). It should be borne in mind that the limiting contour of the mineralized area represents only the threshold, and that the actual overall tenor of the source is undoubtedly several times higher than 2000 ppm or 0.2% Cu. Background for Cu is taken as the median of the analyses of the 23 sediment samples taken from Canadian Creek above its confluence with anomalous Patton Creek, as presented in fig.4 of Archer and Main (1971). Background for Mo is arbitrarily taken as 1 ppm.

Here we see values for computed tenor of source covering a range from 0.6 to 4.0%. The data of table I of Horsnail and Fox show that the pH of the water at sample site 4 was 6.0, enough on the acid side that substantial Cu would still be in solution. At site 3, the pH is down to 7.1 where presumably the bulk of the Cu would be traveling with the sediment. The precipitation of Cu resulting from this change in pH may be responsible for the very high content of Cu in the computed "tenor of source" for site 3. Further downstream, the pH remains essentially constant while the Cu content of the sediment as reflected by the value for Me_m steadily declines, suggesting progressive mixing of the enriched sediments from site 3 with the impoverished sediments of site 4. The variability of the computed "tenor of source" for Mo is at least in part probably the effect of lack of precision of the Mo analyses near the limit of detection of the analytical method.

Chaucha deposit, Ecuador

The Chaucha porphyry copper deposit in Ecuador (Mueller-Kahle, 1972) is located 100 km southeast of Guayaquil. The writer is indebted to the staff of the U.N. Mineral Surveys of Ecuador and Colombia for the data given in Table I. Sample 1 was collected at the new highway bridge over the Río Balao, between Machala and Guayaquil, 45 km west of the deposit. Sample 2 came from the Río Canoa 4.5 km downstream from the western limits of the mineralized area. A_m , the area of the source, is taken as the area enclosed by the contour for 1000 ppm Cu in soil. Background (40 ppm) is the median of the Cu content of sediment in areas within 20 km of the known mineralization. The very high value for computed "tenor of source" at site 2 compared with that at site 1 may again be the effect of precipitation near the source where the pH is being progressively neutralized.

Rosemont deposit, Arizona

The Rosemont porphyry copper deposit, sometimes referred to as the East Helvetia deposit, is located about 50 km southeast of Tucson, Arizona. All samples for this experiment were taken by the writer and analyzed by Skyline Labs of Tucson. As shown in Fig.4 anomalous Cu in the principal drainage system comes from two sources. Samples 10 and 11 drain the area of the Rosemont deposit itself, the largest part of which is not exposed at the daylight

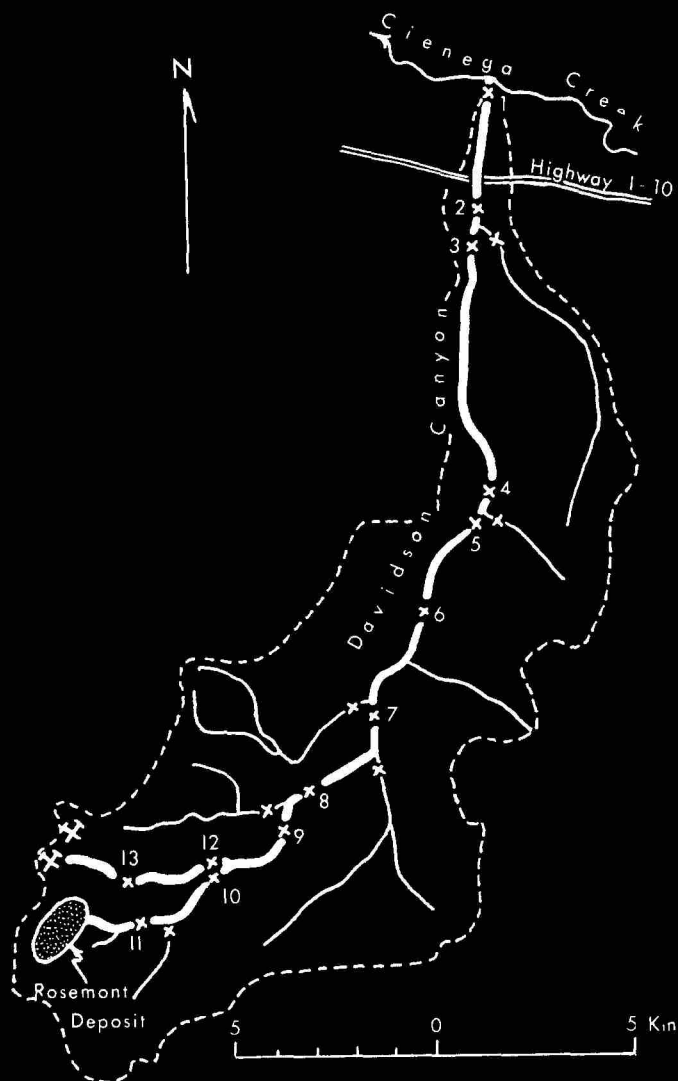


Fig.4. Sediment samples below Rosemont deposit, Arizona.

surface or even at the surface of bedrock. Samples 12 and 13 drain an area of scattered Cu prospects. Because of uncertainties as to the dimensions and grade of the exposed mineralized area, A_m is taken for purposes of computation at a nominal value of 1 km^2 , and no value is assigned to the observed tenor of source, Me_m . Background, Me_b , was taken as the median Cu content of 10 samples from washes, all within 100 km of the Rosemont deposit and all draining $30\text{--}100 \text{ km}^2$ of presumably unmineralized terrain. In this experiment, the applicability of the dilution formula can be judged only by the

relative consistency of successively computed values for Me_m , as no realistic estimate could be made of the grade of the mineralized source itself.

DISCUSSION

A number of features of the formula and its applications deserve a word or two of amplification.

The examples cited above are all porphyry copper deposits, simply because these were the only appropriate case studies available to the author. Although the formula should apply equally rigorously to any type of deposit, a problem arises with high-grade and vein-type deposits in that the area of source becomes a parameter much more difficult to measure in the field. However, once the erosion product of a high-grade deposit has entered the drainage system, the arithmetic of dilution would have to follow the same rules as for disseminated deposits.

The same may be said for water anomalies. Once the anomalous metal in soluble form has entered the water of a drainage system, the arithmetic of dilution of the anomaly must obey the same rules as for sediments, provided of course that there is no feedback between water and sediments.

According to the formula the position of the mineralized source within the drainage basin makes no difference whatever to the value observed at the anomalous site. Every experienced exploration geochemist can cite numerous examples where sediment anomalies are stronger for nearby sources than they are for distant sources. This is probably the result of hydromorphic precipitation of metal as the acid pH of the stream water is neutralized immediately below the orebody. This effect may be illustrated by the data cited above from Casino and Chaucha.

The computation of a value for local background for use in the formula may present certain difficulties. If we know that a given area does not contain anomalies, then the mean of values from that area is a reliable measure of background. However, we often find that the collection of data we are forced to use contains some erratically high values of unknown origin. Although these could be arbitrarily discarded, it would seem better practice to compute background as the median rather than the mean of the available background population, a system which minimizes the effect of such erratically high values.

APPLICATION OF DILUTION FORMULA

The possible usefulness of the dilution formula lies in the fact that of the five parameters contained in the formula, usually four of them can either be measured or reasonably assumed in any given field problem. This leaves just one unknown that can be readily computed. Following are two possible applications of the formula.

Planning sample layouts

In laying out a stream sediment survey, it may be helpful to have some idea of how large a stream or river can be sampled with a reasonable chance of finding an indication of an economic deposit in the upstream drainage basin. Here we may first make an assumption as to the size and grade of the smallest deposit that could be economically viable under the local conditions, and then make an estimate of the minimum anomaly contrast that can be recognized above the background noise level. With the parameters established by these assumptions, we may solve our equation for A_a , the maximum size of the drainage basin below which we may sample and still find a recognizable anomaly.

For example, suppose we want to know how far downstream we can go below a porphyry copper deposit of 1-km² area (A_m) and grade (Me_m) of 0.4% or 4000 ppm and still have an anomaly of, say, twice background. If local background (Me_b) is found to be 15 ppm Cu, then we are looking for a limiting value of 30 ppm (Me_a) in our anomalous stream. We now can compute A_a , the area above our anomalous field site, as follows:

$$A_a = \frac{A_m (Me_m - Me_b)}{Me_a - Me_b} = \frac{1 (4000 - 15)}{30 - 15} = 266 \text{ km}^2$$

In terms of linear distance along the stream source, a 266-km² area would be roughly equivalent to between 15 and 20 km, depending on the shape of the drainage basin. Once this upper limit to the area that could be safely represented by a single sample is established, then sample sites for any given project could be preselected with the aim of providing maximum coverage per sample and hence maximum efficiency.

Interpretation of data

Another application of the formula might be in the interpretation of reconnaissance stream sediment data in terms of priorities for follow-up programs. One way of approaching this problem is to assign an arbitrary value of unity (1 km²) to A_m , the area of exposure of the hypothetical orebody causing the anomalies. If we do this, then the computed grade (Me_m) might be considered as a kind of "anomaly rating" by which we can classify the anomalies according to importance. Our formula here becomes simply:

$$\text{anomaly rating} = Me_m = A_a (Me_a - Me_b) + Me_b$$

It is interesting to note here that if the area above the sample site is itself unity (1 km²), then $Me_m = Me_a$, which is what we would expect. In such a case there is no need to have a value for background.

Table II presents an extract of a series of such computations of relative anomaly ratings on samples from an actual reconnaissance survey carried out

TABLE II

Example of "anomaly ratings" (Me_m) computed from data of stream sediment reconnaissance in South American Cordillera, by formula $Me_m = A_a (Me_a - Me_b) + Me_b$ *

Anomaly number	Metal	Anomaly, Me_a (ppm)	Back-ground, Me_b (ppm)	Drainage area, A_a (km ²)	Anomaly rating, Me_m (ppm)
1	Zn	378		1	378
2	Zn	335		1	335
	Pb	137			137
3	Cu	186	14	600	103,214
	Zn	350	50		180,050
4	Cu	405	14	4	1578
	Zn	302	50		1058
5	Cu	175		1	175
6	Cu	91	8	15	1253
7	Pb	51	9	12	513
8	Cu	295	27	6	1635
9	Mo	2.5	1	1000+	1500+
10	Cu	430		1	430
11	Zn	140	60	40	3260
12	Zn	249	60	10	1950
	Pb	23	9		149
13	etc.				

*Source area (A_m) is assumed to be 1 km².

recently in the South American Cordillera. Here the background was computed as the median of all values for the metal in question within a distance of 10 km from the anomalous sample site.

Table III is an extract of the tabulation of the anomaly ratings of copper

TABLE III

Example of anomaly ratings for copper arranged in order of priority, from same data as Table II

Anomaly rating	Anomaly number	Copper content (ppm)	Drainage area (km ²)
103,214	3	186	600
30,020	84	120	300
19,952	51	251	100
12,525	50	150	100
9425	74	260	40
8860	97	148	100
7775	78	112	80
6793	19	700	10
5120	72	1760	3
4375	etc.		

anomalies from the same survey, arranged in order of computed anomaly rating or priority. At the time this is written, a follow-up of anomaly 3 with the highest anomaly rating for copper has led to the discovery of what appears to be a new porphyry copper deposit.

CONCLUSIONS

An idealized formula is presented relating the significance of a stream sediment anomaly with the size of the drainage basin. Experimental sampling in four field areas draining known but relatively undisturbed porphyry copper deposits appears to confirm the validity of the formula within reasonable limits. The semi-quantitative appraisal of the effect of downstream dilution of anomalies provided by the formula should help (1) in determining how large a stream may be sampled with assurance that no important anomalies will be missed, and (2) in assigning priorities for follow-up of sediment anomalies that take into account the size of drainage basin.

ACKNOWLEDGEMENTS

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The Main Warehouse will have restrooms that will discharge to an onsite wastewater treatment facility that will be permitted under a Type 4 general permit and incorporated into the area-wide permit as discussed in Section 6.5.1.

ND-PS-22 Analytical Laboratory

The Analytical Laboratory will be an enclosed facility constructed on a concrete pad to eliminate the possibility of discharge and is therefore exempt from APP regulation pursuant to A.R.S. §49-250(B)(21).

The Analytical Laboratory will contain a wet laboratory, a reagent storage area, balance rooms, and analytical equipment. Also included is a facility to collect and manage waste chemicals in the laboratory. Disposal of the chemical or laboratory wastes will follow appropriate regulatory requirements.

The Analytical Laboratory will have restrooms that will discharge to an onsite wastewater treatment facility that will be permitted under a Type 4 general permit and incorporated into the area-wide permit as discussed in Section 6.5.1.

ND-PS-23 Administration Building

The Administration Building will be an enclosed facility constructed on a concrete pad to eliminate the possibility of discharge and is therefore exempt from APP regulation pursuant to A.R.S. §49-250(B)(21).

The Administration Building will have restrooms that will discharge to an onsite wastewater treatment facility that will be permitted under a Type 4 general permit and incorporated into the area-wide permit as discussed in Section 6.5.1.

ND-PS-24 Electrical Substation

Transformers associated with the Electrical Substation may contain coolant oils. The transformers will be designed, constructed, and maintained so as not to discharge; they are therefore exempt from APP regulation pursuant to A.R.S. §49-250(B)(22).

Transformers capable of storing 55 gallons or more of oil will be further regulated by the EPA's 40 CFR Part 112 – Oil Pollution Prevention. Rosemont will prepare an SPCC Plan to address the appropriate regulations.

6.3 Other Exempt Facilities

EX-TS-01 Topsoil Stockpile

According to A.R.S. §49-250(B)(20), the storage, treatment, or disposal of inert material is exempt from the aquifer protection program.

Rosemont will stockpile topsoil, growth media, and vegetation that has been stripped from the Project site facilities for use in reclamation activities. The topsoil stockpiles will be managed using the appropriate best management practices to minimize sediment loading in stormwater.

EX-CF-01 Slag Pile – Closed Pre-APP (January 1, 1986)

The Rosemont Smelter was removed from the site prior to January 1, 1986 and only the associated slag pile remains. A photograph of the slag pile is provided on Illustration 6.01. The existing slag pile meets the definition of a closed facility based on A.R.S. §49-201(7)(a) and is therefore exempt from APP regulation pursuant to A.R.S. §49-250(B)(11). As shown on Figure

05, the Slag Pile is located within the footprint of the Dry Stack Tailings/Central Drain Facilities and will be covered by emplaced tailings.



Illustration 6.01 Slag Pile Photo

EX-CF-02 Former Ore Leaching Building – Closed Pre-APP (January 1, 1986)

The Former Ore Leaching Building meets the definition of a closed facility based on A.R.S. §49-201(7)(a) and is therefore exempt from APP regulation pursuant to A.R.S. §49-250(B)(11). The Former Ore Leaching Building ceased operations prior to January 1986 and will not resume operations as a part of this Project. A photograph of the Former Ore Leaching Building is provided on Illustration 6.02. As shown on Figure 05, the Former Ore Leaching Building is located within the footprint of the Open Pit and will be demolished and removed from the site during pit development.



Illustration 6.02 Former Ore Leaching Building Photo

6.4 Stormwater Management Facilities

Stormwater at the Project site will be managed using diversion structures designed so that run-on diverted around APP Regulated Facilities and non-contact stormwater will be discharged